

What is claimed is:

1. A method for controlling a controlled operation by determining  
5 the lag in measured data from at least one variable signal,  
comprising:  
processing the measured data using time-series analysis with a  
filter to produce filtered data with reduced noise content;  
arranging the filtered data in matrices with one column for each  
10 variable signal;  
shifting the columns of the matrices to produce a plurality of  
different shifted matrices, each shifted matrix having a  
given value for the lag in data for each variable signal;  
processing each shifted matrix with a variable signal estimator  
15 to output a variable signal function for each variable signal  
that defines each variable signal in terms of its mathematical  
dependencies on all of the variable signals;  
processing each variable signal function with a criterial function  
to provide an optimal lag value for each variable signal;  
20 processing each shifted matrix with a point calculation algorithm  
to produce a point for each column in each shifted matrix;  
processing each point and each optimal lag value with a lag  
estimator to output a lag function for each lag, each lag  
function defining each lag in terms of its mathematical  
25 dependency on all of the variable signals;  
determining the goodness of fit of each lag function based on the  
most recent filtered data;  
storing at least one lag function based on its goodness of fit;  
and  
30 discarding at least one lag function based on its goodness of fit.
2. The method of claim 1, wherein the filter is a 1-D filter.

3. The method of claim 2, wherein the filter is a time series approximator.

4. The method of claim 1, wherein the filter is an n-D filter.

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5. The method of claim 1, wherein the variable signal estimator is selected from the group consisting of: topological-algebraic infinite-dimensional methods, clustering algorithms, self-organized map (SOM) algorithms, expectation-maximization (EM) algorithms, genetic algorithms (GA), maximum likelihood training of hidden Markov model (MLTHMM) algorithms, neural networks, linear correlation and regression algorithms, nonlinear correlation and regression algorithms, factor analysis (FA) algorithms, and real-time computation of time-recursive discrete sinusoidal transforms (DST) algorithms.

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6. The method of claim 1, wherein the criterial function utilizes optimization methods to provide an optimal lag value for each variable signal.

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7. The method of claim 1, wherein the point calculation algorithm averages the values of each column in a given matrix to produce a point for each column in each shifted matrix.

8. The method of claim 1, wherein the lag estimator is selected from the group consisting of: topological-algebraic infinite-dimensional methods, clustering algorithms, self-organized map (SOM) algorithms, expectation-maximization (EM) algorithms, genetic algorithms (GA), maximum likelihood training of hidden Markov model (MLTHMM) algorithms, neural networks, linear correlation and regression algorithms, nonlinear correlation and regression algorithms, factor analysis (FA) algorithms, and real-time computation of time-recursive discrete sinusoidal transforms (DST) algorithms.

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9. A method for controlling a controlled operation by determining the lag in measured data from at least one variable signal, comprising:

5   arranging the data in matrices with one column for each variable signal;  
shifting the columns of the matrices to produce a plurality of different shifted matrices, each shifted matrix having a given value for the lag in data for each variable signal;  
10   processing each shifted matrix with a variable signal estimator to output a variable signal function for each variable signal that defines each variable signal in terms of its mathematical dependencies on all of the variable signals; and  
processing each variable signal function with a criterial function  
15   to provide an optimal lag value for each variable signal.

10. The method of claim 9, wherein the variable signal estimator is selected from the group consisting of: topological-algebraic infinite-dimensional methods, clustering algorithms,  
20   self-organized map (SOM) algorithms, expectation-maximization (EM) algorithms, genetic algorithms (GA), maximum likelihood training of hidden Markov model (MLTHMM) algorithms, neural networks, linear correlation and regression algorithms, nonlinear correlation and regression algorithms, factor analysis (FA)  
25   algorithms, and real-time computation of time-recursive discrete sinusoidal transforms (DST) algorithms.

11. The method of claim 9, wherein the criterial function utilizes optimization methods to provide an optimal lag value for each  
30   variable signal.

12. A method for controlling a controlled operation by determining the lag in measured data from at least one variable signal, comprising:

arranging the data in matrices with one column for each variable

5        signal;

shifting the columns of the matrices to produce a plurality of different shifted matrices, each shifted matrix having a given value for the lag in data for each variable signal;

processing each shifted matrix with a variable signal estimator

10        to output a variable signal function for each variable signal that defines each variable signal in terms of its mathematical dependencies on all of the variable signals;

processing each variable signal function with a criterial function to provide an optimal lag value for each variable signal;

15        processing each shifted matrix with a point calculation algorithm to produce a point for each column in each shifted matrix; and

processing each point and each optimal lag value with a lag estimator to output a lag function for each lag, each lag function defining each lag in terms of its mathematical  
20        dependency on all of the variable signals.

13. The method of claim 12, wherein the variable signal estimator is selected from the group consisting of: topological-algebraic

25        infinite-dimensional methods, clustering algorithms,

self-organized map (SOM) algorithms, expectation-maximization (EM) algorithms, genetic algorithms (GA), maximum likelihood training of hidden Markov model (MLTHMM) algorithms, neural networks, linear correlation and regression algorithms, nonlinear

30        correlation and regression algorithms, factor analysis (FA) algorithms, and real-time computation of time-recursive discrete sinusoidal transforms (DST) algorithms.

14. The method of claim 12, wherein the criterial function utilizes optimization methods to provide an optimal lag value for each variable signal.

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15. The method of claim 12, wherein the point calculation algorithm averages the values of each column in a given matrix to produce a point for each column in each shifted matrix.

10 16. The method of claim 12, wherein the lag estimator is selected from the group consisting of: topological-algebraic infinite-dimensional methods, clustering algorithms, self-organized map (SOM) algorithms, expectation-maximization (EM) algorithms, genetic algorithms (GA), maximum likelihood  
15 training of hidden Markov model (MLTHMM) algorithms, neural networks, linear correlation and regression algorithms, nonlinear correlation and regression algorithms, factor analysis (FA) algorithms, and real-time computation of time-recursive discrete sinusoidal transforms (DST) algorithms.

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